Plumbing Code / Cross Connection Control Workgroup of the 2002 Recycled Water Task Force

Draft White Paper
November 15, 2002

Introduction

Recycled water may be used in buildings (cooling, toilet and urinal flushing, trap priming, fire suppression systems, industrial purposes, etc), and for irrigation at residential, park, school, and other urban landscape areas.

Regulations and guidelines have been developed to address the public health concerns with the possible misuse of recycled water or the connection of the recycled distribution system with the potable water piping (cross-connection). Misuse occurs when someone unknowingly drinks from a recycled water outlet. A cross-connection can occur during initial construction, when a potable water system is retrofitted to recycled water use and potable water connections are overlooked, or when modifications are made to expand the system or increase pressure.

Portions of three California Codes have been identified as including impediments to recycled water use and are addressed in this white paper. They are the California Plumbing Code (CPC) Section 601.2.2 and 601.2.3 and Appendix J dealing with dual plumbed systems, Title 17 Section 7583 et seq. dealing with cross-connection control, and Title 22 Sections 60313-60616 dealing with recycled water dual plumbed systems. These codes pose problems because of their adoption status in some cases, inconsistencies between codes, and possibly unnecessarily restrictive requirements.

Uniform Plumbing Code Appendix J

Appendix J describes how to safely plumb buildings with both potable and recycled water systems. The appendix has been adopted by the International Association of Plumbing and Mechanical Officials (IAPMO) as part of the Uniform Plumbing Code (UPC) but is not part of the California Plumbing Code because it has not been adopted by a California state agency. The adoption process for the California Plumbing Code is found in Appendix A. San Francisco, and perhaps other jurisdictions will not use Appendix J unless it is adopted by a State agency.

There are numerous inconsistencies with Title 22 Water Recycling Criteria and requirements that may be unnecessarily restrictive given the related code requirements in California. California requires a very high quality recycled water for use within buildings, has rigorous cross-connection control requirements, and has an effective and experienced system for reviewing and approving installations. It would be difficult to work with IAPMO to develop an Appendix J that took advantage of the California conditions and would serve as a national model.

A section-by-section summary of the evaluation and suggested changes for the IAPMO UPC Appendix J is included as Appendix B of this paper and a draft replacement for Appendix J has been developed by the workgroup and is included as Appendix C.

Recommendation:

- **California should adopt its own Appendix J in order to avoid the inconsistencies between the IAPMO version and other California Codes.**

- **Encourage adoption by the Department of Water Resources of the recommended version of Appendix J (included as Appendix C of this paper) at the earliest opportunity.**

California Plumbing Code (CPC) Amendment by the Department of Housing and Community Development

The Department of Housing and Community Development (HDC) initiated amendments to the California Plumbing Code, Sections 601.2.2 and 601.2.3 which covers recycled water systems within HDC controlled occupancies (hotels, apartment houses, employee housing, accessory buildings in mobile home parks, etc.). The Code amendments require that "A universal poison symbol of skull and crossbones shall be provided." The Statement of Reasons for these sections states "… to provide additional measures to protect the health and safety of the public…"

The plumbing code already requires labeling of recycled water piping. The marking requirements for recycled water are continuous along the piping.

The skull and crossbones requirement is perhaps intended to supply a non-English indication that the contents of the pipe are not suitable for ingestion. There is a symbol in the Water Recycling Criteria (CCR Title 22, Section 60310 A) that can be used to indicate that water is not safe for consumption yet not alarm the public.

The quality of recycled water required for use within buildings of the type controlled by HCD (CCR Title 22, Sections 60306 and 60307) is also considered safe for uses such as park and playground irrigation, truck crop irrigation, and swimming – uses where some ingestion is expected. The anticipated ingestion exposure for swimming is 100 mL and the expected risk of illness when swimming in this quality recycled water is approximately 1 in 10,000. It is misleading to suggest that recycled water is a poison.

Recommendations:

- **Request that HCD submit a code change to remove the requirement for the skull and crossbones symbol in Sections 601.2.2 and 601.2.3 of the CPC.**

- **Make the request in time for the California Building Commission's 2003 annual code cycle.**

Title 22 Water Recycling Criteria, Article 5, Sections 60313-60616, Dual Plumbed Recycled Water Systems

The dual plumbed requirements are intended to prevent the unintentional misuse of recycled water and the cross-connection of the recycled water distribution system with the potable water system within buildings and for residential landscaping. These recycled water use sites are called out for special controls because they are believed to be at the greatest risk for unplanned public exposure. The proximity of the complex plumbing systems within buildings and the potential for homeowner modifications in residential situations creates the risk. The dual plumbed section uses a combination of posting, plumbing access restrictions, plumbing labeling, supervision, periodic inspection, and testing to minimize the chance of misuse or cross-connection.

There are two concerns with the dual plumbed requirements.

1. In some counties the requirements are being applied to irrigation use areas not specified in the regulation. The sites that the dual plumbed requirements in Title 22 apply to are identified through a series of definitions in the regulation.
   Section 60301.310 defines “facility” as “any type of building or structure, or a defined area of specific use that receives water for domestic use from a public water system as defined in section 116275 of the Health and Safety Code.”
   Section 60301.250 defines “dual plumbed system” and “dual plumbed” as “a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:
   (a) To serve plumbing outlets (excluding fire suppression systems) within a building or
   (b) Outdoor landscape irrigation at individual residences.”

   Most of the requirements in Title 22, Article 5 (see Appendix D) apply only to dual-plumbed systems – plumbing outlets within buildings and landscape irrigation at individual residences. The requirement of greatest concern is for a test every four years to show that a cross-connection does not exist. A pressure test (alternating shutdown of the potable and recycled water systems) has been the accepted test. The cost and service disruption associated with the test is an impediment to dual-plumbed recycled water systems.

   Some county health departments have applied these requirements to all sites with both potable and recycled water service. This practice is due, in part, to a misunderstanding regarding the use of the definitions presented above.

2. Title 22, Section 60316(a) requires that “The recycled water system shall also be tested for possible cross-connections at least once every four years.” The regulation Section 60314(a)(3) allows the use of a pressure (shut down), dye, or other test method. The shut down test is commonly used because it is considered conclusive, but it is expensive and disrupts service. Other methods of assuring the absence of a cross-connection in buildings were incorporated into the recommended California Appendix J included in Appendix C of this paper.

Recommendations:

- **DHS guidance should be prepared that would clarify the intent and applicability of Title 22, Article 5. If the guidance does not deal with the issue the regulation should be rewritten.**

- **DHS guidance should be prepared that would clarify the requirement for testing in Title 22, Section 60316(a) and stress that alternatives to a pressure test are sufficient in most cases.**

- **DHS should amend Title 22, Article 5 to incorporate inspection and testing requirements consistent with those proposed in the recommended California Appendix J included as Appendix C of this paper.**

Title 17 Cross-connection Control

A cross-connection is an interconnection between a drinking water line and a piped system containing some non-potable fluid. A cross-connection could allow the non-potable fluid to flow under pressure or be siphoned into the drinking water system. Cross-connections have resulted in non-potable fluids displacing the drinking water in piping serving a home, a building, or an entire neighborhood. The risk posed by a cross-connection depends on the toxicity, infectivity, and apparent potability of the fluid. Appendixes E and F of this paper include an excerpt from Title 17 and a list of relevant cross-connections.

A cross-connection control assembly restricts the flow in a pipe to one direction. There are three types of recognized cross-connection control assemblies with their reliability (effectiveness) proportional to their cost.

The regulation requires that drinking water plumbed systems be evaluated for the likelihood of a cross-connection and the hazard posed by the cross-connection. The regulation identifies the minimum level of control required (the type of cross-connection control assembly) for specified common situations.

There are two concerns expressed by workgroup members with the existing cross-connection control regulations.

1. There is a concern that the existing cross-connection control regulations do not treat recycled water systems in a manner proportional to the risks they pose relative to other non-potable piped fluid systems. The existing regulations may not reflect the actual risk posed by a potential cross-connection with disinfected tertiary recycled water.

2. There is the concern that air gaps are considered the superior cross-connection control mechanism. It is suggested that they are not significantly superior to reduced pressure principle RPP devices, that they can allow extraneous contaminants to enter the system, and they are sometimes illegally defeated with a bypass to avoid the loss of head.

DHS is drafting proposed changes to the cross-connection control regulations. Informal comments will be accepted through December 2, 2002 for consideration prior to the submission of a formal regulation package.

There are concerns with the proposed requirements in the working draft of revisions. There would be a requirement for a double check valve on fire systems supplied by the potable water system where recycled water is used in a separate piping system within the same building. This requirement would make it difficult or impossible to retrofit a building with an existing fire system. The double check assembly would cause a pressure drop of approximately 10 psi.

This might be enough to compromise the performance of a fire system that has not been designed for the head loss. Fire systems may not be engineered to exactly fit a building of site specification and it may be that a fire system can absorb a 10 psi drop without compromising the system. New systems can be designed to address the pressure drop.

Another issue to resolve is a conflict between the current Title 17 requirements and the California Plumbing Code. The California Fire Marshall is opposed to backflow devices on Class I and II fire systems and has amended Sections 603.4.18 and 603.4.19 of the 2001 California Plumbing Code to prohibit the installation of these devices.

Recommendations:

- **Encourage stakeholders to review the DHS draft changes of the Title 17 Cross-connection Control requirements and comment as appropriate.**

- **Support a thorough assessment of the risk associated with a cross-connections between disinfected tertiary recycled water and potable water. The risk assessment should identify:**
  - **The risk of a worst case cross-connection;**
  - **The likelihood of a cross-connection in various use situations; and**
  - **Microbiological and chemical exposure risks.**

  The risk assessment would provide a scientific basis for regulations controlling potential cross-connections.

List of Appendices

A. Adoption Process for the California Plumbing Code and Building Standards (Bulletin 99-01)

B. Summary of the evaluation and suggested changes for the IAPMO UPC Appendix J

C. Draft Appendix J for California

D. Referenced Sections of Title 22, Water Recycling Criteria

E. Referenced Sections of Title 17 Relating to Cross connection Control

F. Cross-connection Incidents

Appendix A
Adoption process for the
California Plumbing Code and Building Standards
(Bulletin 99-01)

Note: This document or an equivalent explanation of the California Building Standards Commission processes will be inserted here.

Appendix B
Summary of the evaluation and suggested changes for the IAPMO UPC
Appendix J

Note: The rationale for the draft presented in Appendix C will be inserted here.

Appendix C

September 9, 2002
DRAFT FOR THE CALIFORNIA PLUMBING CODE
Recycled Water Systems
Replaces UPC Appendix J

J1 Recycled Water Systems - General

(a) This appendix applies to the installation, construction, alteration, and repair of recycled water systems intended to supply toilets (water closets), urinals, and trap primers for floor drains and floor sinks. The recycled water system shall not have any connections to the potable water system.

(b) No permit shall be issued until complete plumbing plans have been submitted and approved by the Administrative Authority. No changes to the recycled water system or potable water system may be made without first obtaining permits and approval from the Administrative Authority.

(c) Before the building may be occupied, the installer shall perform an initial cross-connection test using a temporary connection to a potable water source and the test shall be ruled successful before the recycled water supply can be connected. This testing shall be conducted in the presence of the Administrative Authority or other authorities that have jurisdiction. See Section J8 for further details.

J2 Definitions

The terms “reclaimed water” and “recycled water” have the same meaning and either may be used in place of the other. The more modern term is “recycled water”, and is the term used throughout this Code.

J3 Permit

It is unlawful to construct, repair, or modify a recycled water system without first obtaining a permit to do such work from the Administrative Authority.

J4 Drawings and Specifications

(a) Drawings and specifications for recycled water systems shall be in accordance with the requirements identified in Chapter 1, Administration, of the California Plumbing Code.

(b) The drawings and specifications shall provide sufficient detail to determine compliance with the requirements of this Appendix and the California Plumbing Code.

J5 Pipe Material / Pipe Identification

(a) Recycled water piping and fittings shall be as required in the California Plumbing Code.

(b) All recycled water pipe shall be permanently marked to identify that it contains recycled water. This may be accomplished by labeling piping using purple adhesive plastic tape along the entire length of the pipe or using non-metallic pipe manufactured with purple color integral to the material. For either pipe material, the identification system shall be clearly legible and installed so that the following wording is clearly visible: “Caution: Recycled Water – Do Not Drink”.

J6 Installation

(a) The portions of the recycled water piping system in areas subject to access by the general public shall not include any hose bibbs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.

(b) The recycled water system and the potable water system within the building shall be provided with the required appurtenances (valves, air vacuum relief valves, etc.) to allow for testing as required by Section J8 of this appendix.

J7 Signs

(a) Within each bathroom or restroom facility where recycled water is used, a sign shall be installed with the following wording:

TO CONSERVE WATER,
THIS BUILDING USES RECYCLED WATER TO FLUSH TOILETS AND URINALS

(b) Each equipment room containing recycled water equipment shall have a sign posted with the following wording in one (1) inch (25.4 mm) letters on a purple background:

CAUTION
RECYCLED WATER, DO NOT DRINK.
DO NOT CONNECT TO DRINKING WATER SYSTEM.
NOTICE
CONTACT BUILDING MANAGEMENT BEFORE
PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near recycled water equipment.

(c) Where tank-type toilets (water closets) are flushed with recycled water a permanent sign (such as plastic or stainless steel) shall be installed inside the tank to warn that the water within the tank is not a suitable emergency water supply. The sign wording shall be: RECYCLED WATER – DO NOT DRINK.

(d) Each recycled water valve within a wall shall have its access door into the wall equipped with a warning sign approximately six (6) inches by six (6) inches (152.4 mm x 152.4 mm) with wording in one half (1/2) inch (12.7 mm) letters on a purple background. The size, shape and format of the sign shall be substantially the same as that specified in subsection (b) above. The signs shall be attached inside the access door frame and shall hang in the center of the access door frame. This sign requirement shall be applicable to any and all access doors, hatches, etc. that provide access to recycled water piping and appurtenances.

(e) Valve Seals. The master recycled water shut-off valve and/or the recycled water meter curb cock and each valve within a wall shall be sealed so as to prevent operation without breaking the seal after the recycled water system has been approved, and placed into operation. These seals shall either be a crimped lead wire seal, or a plastic breakaway seal which, if broken after system approval shall be deemed conclusive evidence that the recycled water system has been accessed. The seals shall be purple and sequentially numbered with the words "RECYCLED WATER", and shall be supplied by the recycled water purveyor, or by other arrangements acceptable to the Administrative Authority.

J 8 Inspection and Testing

(a) Recycled water piping shall be tested as outlined in this Code for testing of potable water piping.

(b) An initial Cross-Connection Test and subsequent Annual Visual System Inspection shall be performed as follows:

(1) Annual Visual System Inspection. A visual system inspection shall be conducted annually by the Administrative Authority or other authorities having jurisdiction.

(i) Meter locations of the recycled water and potable water lines shall be checked to verify that no modifications were made, or cross-connections are visible.

(ii) All pumps and equipment, equipment room signs, and exposed piping in equipment room shall be checked.

(iii) All valves shall be checked to insure that valve lock seals are still in place and intact. All valve access door signs shall be checked to verify that no signs have been removed.

(iv) If the visual test indicates that the recycled plumbing has been modified, a Cross-Connection Test is required.

(2) Cross-Connection Test. The applicant shall perform the following test before the building may be occupied or at other times when there is material reason to believe that the system separation has been compromised. The test shall be conducted in the presence of the Administrative Authority or other authorities having jurisdiction to determine if a cross-connection has occurred.

Cross-connection testing, following the procedures listed below, shall not be required, unless the results of the visual inspection indicate it is needed. Alternate inspection and testing requirements may be allowed by the Administrative Authority for institutional or industrial buildings where shutting off the water is not practical. The recycled water purveyor, or other designated appointee may substitute for the Administrative Authority in the above-mentioned inspection and tests unless the Administrative Authority objects.

(i) The potable water system shall be activated and pressurized. The recycled water system shall be shut down and completely depressurized.

(ii) The potable water system shall remain pressurized while the recycled water system is depressurized. The minimum period the recycled water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and recycled water distribution systems.

(iii) All fixtures, potable and recycled, shall be tested and inspected for flow. Flow from any recycled water system outlet shall indicate a cross-connection. No flow from a potable water outlet would indicate that it may be connected to the recycled water system.

(iv) The drain on the recycled water system shall be checked for flow during the test and at the end of the period.

(v) The potable water system shall then be completely depressurized.

(vi) The recycled water system shall then be activated and pressurized. For the initial test, a temporary connection to a potable water supply will be required to test the recycled water system plumbing.

(vii) The recycled water system shall remain pressurized while the potable water system is depressurized. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis.

(viii) All fixtures, potable and recycled shall be tested and inspected for flow. Flow from any potable water system outlet shall indicate a cross-connection. No flow from a recycled water outlet would indicate that it may be connected to the potable water system.

(ix) The drain on the potable water system shall be checked for flow during the test and at the end of the period.

(x) If there is no flow detected in any of the fixtures which would have indicated a cross-connection, the potable water system shall be repressurized.

(3) In the event that a cross-connection is discovered, the following procedure shall be activated immediately:

(i) Recycled water piping to the building shall be shut down at the meter, and the recycled water system shall be drained at the riser.

(ii) Potable water piping to the building shall be shut down at the meter.

(iii) The cross-connection shall be uncovered and disconnected.

(iv) The building shall be retested following procedures listed in subsections (b)(1) and (b)(2) above.

(v) The potable water system shall be chlorinated with fifty (50) parts per million (ppm) chlorine for twenty-four (24) hours.

(vi) The potable water system shall be flushed after twenty-four (24) hours, and a standard bacteriological test shall be performed. If test results are acceptable, the potable water system may be recharged.

J 9 Sizing

Recycled water piping shall be sized as outlined in the California Plumbing Code for sizing potable water piping.

Appendix D

Referenced Sections of Title 22, Water Recycling Criteria

California Code of Regulations

Division 4. Environmental Health

Chapter 3. Water Recycling Criteria

ARTICLE 5. DUAL PLUMBED RECYCLED WATER SYSTEMS.

Section 60313. General Requirements.

(a) No person other than a recycled water agency shall deliver recycled water to a dual-plumbed facility.

(b) No recycled water agency shall deliver recycled water for any internal use to any individually-owned residential units including free-standing structures, multiplexes, or condominiums.

(a) No recycled water agency shall deliver recycled water for internal use except for fire suppression systems, to any facility that produces or processes food products or beverages. For purposes of this Subsection, cafeterias or snack bars in a facility whose primary function does not involve the production or processing of foods or beverages are not considered facilities that produce or process foods or beverages.

(d) No recycled water agency shall deliver recycled water to a facility using a dual plumbed system unless the report required pursuant to section 13522.5 of the Water Code, and which meets the requirements set forth in section 60314, has been submitted to, and approved by, the regulatory agency.

Section 60314. Report Submittal.

(a) For dual-plumbed recycled water systems, **t**he report submitted pursuant to section 13522.5 of the Water Code shall contain the following information in addition to the information required by section 60323:

(1) A detailed description of the intended use area identifying the following:

(A) The number, location, and type of facilities within the use area proposing to use dual plumbed systems,

(B) The average number of persons estimated to be served by each facility on a daily basis,

(C) The specific boundaries of the proposed use area including a map showing the location of each facility to be served,

(D) The person or persons responsible for operation of the dual plumbed system at each facility, and

(E) The specific use to be made of the recycled water at each facility.

(2) Plans and specifications describing the following:

(A) Proposed piping system to be used,

(B) Pipe locations of both the recycled and potable systems,

(C) Type and location of the outlets and plumbing fixtures that will be accessible to the public, and

(D) The methods and devices to be used to prevent backflow of recycled water into the public water system.

(3) The methods to be used by the recycled water agency to assure that the installation and operation of the dual plumbed system will not result in cross connections between the recycled water piping system and the potable water piping system. This shall include a description of pressure, dye or other test methods to be used to test the system every four years.

(b) A master plan report that covers more than one facility or use site may be submitted provided the report includes the information required by this section. Plans and specifications for individual facilities covered by the report may be submitted at any time prior to the delivery of recycled water to the facility.

Section 60315. Design Requirements.

The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of sections 7602 (a) and 7603 (a) of title 17, California Code of Regulations, and the approval of the public water system has been obtained.

Section 60316. Operation Requirements.

(a) Prior to the initial operation of the dual-plumbed recycled water system and annually thereafter, the Recycled Water Agency shall ensure that the dual plumbed system within each facility and use area is inspected for possible cross connections with the potable water system. The recycled water system shall also be tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the method described in the report submitted pursuant to section 60314. The inspections and the testing shall be performed by a cross connection control

specialist certified by the California-Nevada section of the American Water Works Association or an organization with equivalent certification requirements. A written report documenting the result of the inspection or testing for the prior year shall be submitted to the department within 30 days following completion of the inspection or testing.

(b) The recycled water agency shall notify the department of any incidence of backflow from the dual-plumbed recycled water system into the potable water system within 24 hours of the discovery of the incident.

(c) Any backflow prevention device installed to protect the public water system serving the dual-plumbed recycled water system shall be inspected and maintained in accordance with section 7605 of Title 17, California Code of Regulations.

Appendix E

Referenced Sections of Title 17 Relating to Cross-connection Control

DIVISION 1. STATE DEPARTMENT OF HEALTH SERVICES
CHAPTER 5. SANITATION (ENVIRONMENTAL)
GROUP 4. DRINKING WATER SUPPLIES
ARTICLE 2. PROTECTION OF WATER SYSTEM

Section 7604. Type of Protection Required.
The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the degree of hazard that exists on the consumer's premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double check Valve Assembly--(DC), Reduced Pressure Principle Backflow Prevention Device--(RP) and an Air gap Separation--(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user's connection to premises with various degrees of hazard, are given in Table 1. Situations not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.

TABLE 1
TYPE OF BACKFLOW PROTECTION REQUIRED

Degree of Hazard	***Minimum Type of Backflow Prevention***
(a) Sewage and Hazardous Substances	
(1) Premises where there are waste water pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(2) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a	AG

single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	
(3) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.	RP
(b) Auxiliary Water Supplies	
(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier.	RP
(c) Recycled Water	
(1) Premises where the public water system isused to supplement the recycled water supply.	AG
(2) Premises where recycled water is used, other than as allowed in paragraph (3), and there is no interconnection with the potable water system.	RP
(3) Residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval of the local public water supplier, or the Department if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow protection plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a).	DC
(d) Fire Protection Systems	
(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected).	DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used.	DC
(4) Buildings where the fire system is supplied from the public water system and where recycled water is used in a separate piping system within the same building.	DC
(e) Dockside Watering Points and Marine Facilities	
(1) Pier hydrants for supplying water to vessels for any purpose.	RP
(2) Premises where there are marine facilities.	RP
(f) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that they do not exist.	RP
(g) Premises where there is a repeated history of cross-connections being established or re-established.	RP

Appendix G
Summary of Select Recycled Water Cross-connection Incidents in California
August 2002

Note: 'RW' denotes Recycled Water, 'PW' denotes Potable Water

Date	Location	Type of Occurrence	Impacts	Cause(s) / Comments
1991	Las Virgenes MWD	x-conn. between HOA common area irrig. system and private residence;	Number of homes impacted unknown; no reported illnesses	Illegal or erroneous connection; duration may have been greater than one-year but undetermined; RW at higher pressure than PW
Mid 1990's	CYA - Preston	x-conn. between dual-plumbed RW system and dental chair oral-rinse	None known; no reported illnesses	Poor documentation of piping networks and modifications; all piping of same color
1992	Santa Margarita WD	x-conn. between HOA common area RW irrig. system and house PW irrig. system	None known; no reported illnesses	Retrofit of common area irrigation system to RW; no labeling I.D of RW system; illegal connection presumably by prior homeowner
1993	Elsinore Valley MWD	x-conn. between residential PW irrigation system and adjacent golf course RW irrigation system	None known; no reported illnesses	Homeowner constructed illegal connection. Discovered during site inspection when owner complained of high water bills
1994	Cal Poly Pomona	x-conn. between RW and PW internal piping systems at a dual plumbed facility	Boil water advisory issued; no reported illnesses	Improperly trained/experienced site personnel; no review/approval of dual plumbed facility
1995	Irvine Ranch WD - Tustin Auto Center	x-conn. between RW and PW irrigation systems	None known; RPPBA at PW irrigation meter	Illegal cross-conn. presumably constructed by landscape contractors during lot changes, not during initial construction

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Date	Location	Type of Occurrence	Impacts	Cause(s) / Comments
1996	City of Lakewood public school	New drinking fountains connected to RW system	None known; no reported illnesses	School booster club doing volunteer work conducted the installation without proper oversight of knowledgeable personnel
1997	City of Lakewood	Used fire hydrant carrying RW to fill an adjacent PW storage tank	None known; no reported illnesses	Hydrant was a retrofit from a PW line and never appropriately identified as being RW; tank fed PWS for approximately one week prior to discovery
1997	City of Lakewood	Direct connection (unprotected) between PW service line to golf course and the RW irrigation system	None known; no reported illnesses	No pipe identification for buried RW line; duration unknown but course was retrofitted in 1995
1997	Las Virgenes MWD	Illegal connection between HOA common area irrigation system and private residence backyard irrigation system	1650 homes potentially impacted, only two confirmed; no reported illnesses	Illegal connection; duration estimated at <8 hours; RW at higher pressure than PW; significant media coverage
1998	City of San Diego North City Water Reclamation Plant	Four interconnections between on-site RW irrigation system with PW fire system.	None - RPPBD's were provided	Poor oversight/control of private landscape contractor
1999	Padre Dam MWD -Big Rock Park	Drinking fountain at tennis court supplied with RW following retrofit	Unknown	Inadequate/ mapping of on-site facilities; shutdown test did not take into account topography so fountain appeared to be on but it was simply draining water from higher elevation; duration of occurrence approximately 9 months; moderate media coverage
1999	Irvine Ranch WD - Irvine Entertainment Center	Construction company plumbed RW to 3 on-site trailers for toilet and wash sinks	None known	Construction superintendent failed to understand or abide by the Rules of Service; they had bottled water' no PW service was supplying trailers

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Date	Location	Type of Occurrence	Impacts	Cause(s) / Comments
2000	City of Newport Beach - The Bluffs Development	Retrofit of irrigation system from PW to RW without complete elimination of all interconnections	Not discovered for approx. 9 months; Impacted approx. 80 homes; No reported illnesses.	Inadequate maps/records; RW at higher pressure than PW; shutdown test duration may have been inadequate; significant media coverage.
2000	City of San Clemente	Retrofit of RW irrigation system on golf course to PW for watering greens without complete elimination of all interconnections	None: PW irrigation line protected by RPPBA	During retrofit, overlooked an unknown connection which went undetected for approx. 5 years due to closed gate valve
2001	El Dorado ID - Serrano	New residence dual plumbed for front/backyard irrigation had premise service lines switched during construction	Residents consumed RW for approx. 7 months	Construction errors at the curb during construction/improper line identification and meter installation
2001	Marin MWD - Northview Development	New residence dual plumbed for front/backyard irrigation had premise service lines switched during construction	Homeowner reported illness - outcome unknown	Miscommunication by various field personnel; RW system was being supplied with PW during 2-month period of occupancy prior to discovery; contractor failed to correctly mark PW and RW lines.
2001	Carlsbad MWD - Aviara Masters Assoc.	Illegal connection between private residence backyard irrigation system and inactive RW piping system.	None - discovered before activated	Uniformed homeowner and landscape contractor although color coding was in place
2002	City of Carlsbad - Bella Lago subdivision	Abandoned 3-inch diameter RW found in backyard of newly constructed residence	Pool contractor broke line (and thus discovered it) during excavation	Poor oversight of RW line locations following soil compaction and subsequent home building.

Date	Location	Type of Occurrence	Impacts	Cause(s) / Comments
2002	Cal Poly Pomona - Bldg 79-B	PW service line to building was connected directly to RW irrigation line.	Bldg. had been occupied for 3-days prior to discovery; No illnesses reported	Inadequate mapping, pipe identification, facility oversight; Compliance Order issued by CDHS